

What is claimed is:

1. A method for forming a high-Re-content alloy film which contains Re at 98 % or more by atomic composition, said method comprising performing an electroplating process using an electroplating bath which contains an aqueous solution including:

a perrhenate ion in a concentration of 0.1 to 8.0 mol/L;

at least one ion selected from the group consisting of nickel, iron, cobalt and chromium (III) ions, in a total concentration of 0.005 to 2.0 mol/L;

at least one of a Li ion and a Na ion, in a total concentration of 0.0001 to 5.0 mol/L; and

at least one organic acid selected from the group consisting of carboxylic acid, hydroxycarboxylic acid and amino acid, in a concentration of greater than 5.0 to 15.0 equivalents to the concentration of all of said metal ions,

wherein said electroplating bath has a pH of 0 to 8, and a temperature of 10 to 80°C.

2. The method as defined in claim 1, wherein said alloy film to be formed has a composition consisting of 98% or more, by atomic composition, of Re, with the remainder being at least one selected from the group consisting of Ni, Co, Fe, Mn, Cr, Mo, W, Nb, Ta, Hf, Si, Al, Ti, Mg, Pt, Ir, Rh, Au, Ag, P, B, C, Y and Ce, and inevitable impurities.

3. A method for forming a high-Re-content alloy film which contains Re in the range of 65 to less than 98% by atomic composition, said method comprising performing an electroplating process using an electroplating bath which contains an aqueous solution including:

a perrhenate ion in a concentration of 0.1 to 8.0 mol/L;

at least one ion selected from the group consisting of nickel, iron and cobalt ions, in a total concentration of 0.005 to 2.0 mol/L;

a Cr (III) ion in a concentration of 0.1 to 4.0 mol/L; and

at least one of a lithium ion and a sodium ion, in a total concentration of 0.0001 to 5.0 mol/L,

wherein said electroplating bath has a pH of 0 to 8, and a temperature of 10 to 80°C.

4. The method as defined in claim 3, wherein said alloy film to be formed has a composition consisting of 65 to less than 98%, by atomic composition, of Re, with the remainder being at least one of Ni, Fe and Co.

5. The method as defined in claim 3 or 4, wherein said electroplating bath contains an organic acid in a concentration of 0.1 to 5.0 equivalents to the concentration of all of said metal ions.

6. The method as defined in either one of claims 1 to 3, wherein said electroplating bath contains at least one ion selected from the group consisting of potassium, rubidium, cesium, calcium, strontium and barium ions, wherein the total concentration of said at least one of lithium ion and sodium ion in said electroplating bath is greater than the total concentration of said at least one ion selected from the group consisting of potassium, rubidium, cesium, calcium, strontium and barium ions.

7. The method as defined in either one of claims 1 to 3, wherein said electroplating bath contains a sulfate ion in a concentration of 0.0001 to 5.0 mol/L, and a chloride ion in a concentration of 0.0001 to 5.0 mol/L.